Changing urban areas using landscape scale ecological processes and thinking

James, P, Millward, A, Morrison, K, Bishop, OJ and Dennis, Matthew

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Proceedings of a symposium held on 11th September 2012 as part of the IALE European Congress – Changing European Landscapes: Landscape ecology, local to global – Manchester 9th-12th September 2013

Contents

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Oral Presentations

Changing urban areas using landscape scale ecological processes and thinking (James *et al*.)

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Abstract

The landscape of urban areas is unique, dissimilar to all other landscapes studied by ecologists: it appears to be dominated by residential and commercial buildings, paved surfaces, roads, railways and so on. However, urban landscapes are crammed with life: ecosystems, biodiversity, and, of course, people. Urban environments are a dense mix of many different types of structures (organic, inert, and man-made; natural and modified). And these landscapes are growing, becoming ever more pervasive across the globe. Anthropogenic and ecological processes: life processes, interactions and adaptations; movement of materials and energy through living communities; successional development of ecosystems; and dynamic changes in abundance and distribution of organisms and biodiversity in the context of the environment, occur, perhaps more so in urban environments than elsewhere. These processes are modified in identifiable ways within the urban landscape.

The convenors of this symposium will illustrate these processes and their modifications through examples drawn from their own academic and professional practice, they will present an overview of the contributions made within the symposium and they will raise questions about the future agenda for research into urban ecology. In particular they will focus on the ecosystem approach and how that is being operationalized.

Text of the Introduction delivered by Professor P. James on behalf of the symposium convenors

Between 1970 and 2000 there was a worldwide increase in urban land area of 58,000 km2. India, China, and Africa experienced the highest rates of urban land expansion, and the largest change in total urban extent occurred in North America. Across all regions and for all three decades, urban land expansion rates were higher than or equal to urban population growth rates, suggesting that urban growth is becoming more expansive rather than more compact.

Estimates of contemporary urban land cover across the globe vary by a factor of ten: ranging from 307,575 km2 to 3,524,108 km2. Such a wide variation in baseline data makes predictions of future urban land cover even more variable. Seto et al. (2011) predicted that by 2030, global urban land cover will increase by between 430,000 km2 and 12,568,000 km2, with the most likely estimate being 1,527,000 km2. That is to say something in the order of 30 times the expansion that occurred in the previous 30 years and which will result in a doubling of the urban environment in the next 17 years. Though these data are imprecise, the take home message is clear: urban areas, the urban biome, is expanding and expanding rapidly.

Based on such statistics and those often quoted concerning the growth in the urban population, it is hardly surprising that the urban biome is now attracting the attention of academics and practitioners from diverse disciplines: planners, sociologists, health professionals, transport geographers, and so on and including urban landscape ecologists.

The International Association of Landscape Ecology (IALE) was founded in 1982, 43 years after the term ‘landscape ecology’ was first used by Carl Troll, a German geographer, in 1939. A division exists between European and North American landscape ecology. Almo Farino defined the division in an editorial in Landscape Ecology (Farina, 1993). American landscape ecology is striving for

advancement of theory, it is concerned with flows of energy and matter across landscapes, which can be composed of many interacting ecosystems. There is a focus on the spatial dimensions, regularities of arrangement, distribution, and contents of ecosystems. In contrast the European approach is more practical, seeking to build integrated social-economic-landscape systems, which can directly contribute to problem solving. In this symposium we are following the European tradition.

Taking this European approach means that we become concerned with multi-functional landscapes, integrated landscape management, sustainable development and resilient cites. Research tends to be inter- or multi-disciplinary and is often trans-disciplinary - a research strategy that crosses many disciplinary boundaries to create a holistic approach. The outputs of such research are used to understand and support decision-making processes and in the implementation of decisions at the house, neighbourhood, city and city-region level. This European perspective suggests that social and natural systems should be considered. And, actually, it goes further by implying that the social and natural systems should be considered as one unified system.

Along with the development of thinking in urban ecology, there has been a shift in emphasis within the thinking of those involved in biodiversity conservation. The shift can be thought of a move through four stages: nature for itself, nature despite people, nature for people and, finally, nature and people. The shift in emphasis moves from considering nature and people as disparate, through phase where the focus was on conserving biodiversity irrespective of this influence, and where the value of nature to people was recognised, to a situation where the consideration is of people and nature as part of one system, a socio-ecological system. This shift in emphasis is fundamental and is no more relevant than in urban areas. Nature and people, considered as a joint system encourages thinking about the resilience of urban areas to perturbations that may be short term (shocks) and long term (stresses), such as the financial crisis of 2007-08 and to the effects of climate and demographic change. Such a joined up system encourages thinking about adaptation, rather than preservation or conservation – a very different concept when applied to thinking about the plant communities that grow (are managed and allowed to grow) in urban areas. This is thinking in a very different way to that which focuses on individual species or habitats, or about the threats (a word that has many negative connotations and is not always helpful in debates with other professions), and even takes the debate beyond that of ecosystem service valuation. Instead nature and people (or people and nature) prompts thinking about possible futures that may be different from maintenance of the status quo.

As many recognize, reconciling people and nature is now one of society's central challenges. We need to create a scientific thinking, that feeds into new political and governance structures, which will help in understanding the fundamental needs of human and natural systems and allow them to coexist. We see the beginnings of this in the new structures that emerged after the financial crisis, but are these new structures more resilient than the old?

Before we can talk in detail about solutions, we need to fundamentally alter the way we see our situation. We need to rise above all the details, to see our problems in the big picture. We need to stop trying to fix the environment and figure out how to manage the socio-ecological system. To do that, we need to understand the socio-ecological system: how has it evolved? What does it look like now?

In this symposium - ‘changing urban areas using landscape scale ecological processes and thinking’ - we wish to explore how this bigger picture develops. We wish to explore how the four core processes that operate in any ecosystem: solar energy flow, mineral cycling, water cycling and ecological succession operate alongside people in urban areas. We wish to explore how landscape-level ecosystem processes including primary production, evapotranspiration, decomposition, and the spread of disturbance across a landscape be they natural – windstorms, lightening, pathogens, floods, and fire) or anthropogenic in origin (habitat removal, vegetation management) are affected by social processes such as changes in landscape structure (e.g. habitat fragmentation and patch size), and we wish to examine how the movement of matter and nutrients across heterogeneous landscapes is influenced by urbanization.

The challenges that I have outlined are big, both in terms of changing thinking and practice; and I have demonstrated that they are relevant to the issues that face us today. In this seminar, in the

presentations we shall hear and the poster we shall view, we take one of the first steps towards addressing these issues and towards more resilient, socially equitable cities.

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The use of landscape-scale botanical data to implement ecological enrichment in the Birmingham and Black Country Nature Improvement Area (Trueman *et al*.)

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Abstract:
A full botanical survey of Birmingham and the Black Country (Trueman et al., in press) was undertaken between 1997 and 2011, accumulating almost ¼ million records. This provided a database of the distribution of 1449 plant taxa over 715 kilometre squares.

Coincidence mapping of key species for nature conservation or 'axiophytes' (Lockton, 2011) has been used to identify and delimit the botanical aspects of the ecological core areas (Lawton et al., 2010) of the conurbation. These have been mapped to attempt to describe the extant ecological network of Birmingham and the Black Country (Fig.1).

Multivariate analysis of the dataset (Hill et al., 2005) has allowed the division of the conurbation into zones according to the predominance of floras associated with industrial, residential and semi-natural habitats and subdivisions thereof which has illuminated the important role of certain features such as canals in the ecological network and suggested strategies for their enhancement.

In 2012 Birmingham and the Black Country was awarded the status of a Nature Improvement Area with the aim of creating an urban landscape permeated by a network of high quality greenspace rich in wildlife and enjoyed by the people who live and work here.
The Flora analysis has been used as an input into implementing this aim. On the basis of the information in the analyses extensions of the existing core areas have been proposed in order to form a coherent network (Fig. 2). The paper will discuss the analysis and its current application in the development and implementation of the NIA aims.

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Analyzing the perception of water surfaces in urban landscapes using eye tracking (Dupont *et al*.)

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Abstract:
Landscape is an important public interest as it determines, in part, the quality of life for people everywhere. In urban landscapes, rivers, canals, ponds and other water surfaces contribute to the ecological value of the city. However, little is known about how the public perceives these landscape features and how they visually observe this 'urban ecology', while this perception could be valuable for urban planning and design. A way to objectively measure how people observe landscapes is offered by the technology of eye tracking. By continuously recording the point-of-regard and the eye movements of an observer while looking at an image, eye tracking makes it possible to reconstruct the whole scan path made by the observer. From these data, the objects which drew much or little attention can be extracted and the general observation pattern can be analyzed. In our study, we use landscape photographs, which have been demonstrated to be valid surrogates for in situ landscapes, as a basis for an eye tracking experiment. In particular, a set of photographs of urban landscapes, in which water surfaces like rivers, canals or ponds are present, are tested to determine to which degree water attracts people's attention. For comparison, photograph simulations in which these water surfaces were replaced by another land use, are tested as well. Furthermore, we analyze if the degree to which the surrounding landscape is reflected in the water surface influences if and how people observe these water bodies. Photographs containing water surfaces with clear reflections, vague reflections and without any reflection of the surrounding landscape are therefore included in the eye tracking experiment. Finally, we also investigate if the landscape type, in which the water surface is situated, has an effect on the view pattern. To this end, observation patterns made in photographs taken in a rural landscape are compared to the ones occurring in images representing a more urban context. The eye tracking experiment was executed using a non-portable iView X RED eye tracking system with a sample rate of 120Hz meaning that the point-of-regard is recorded 120 times per second. The participant group consists of graduate geographers and landscape architects. During the test, the participants were instructed to attentively observe 63 landscape photographs, without executing specific search tasks. The results of the experiment are statistically analyzed and visualised in two-coloured heat maps. The results of this study may be helpful in how to visually integrate ecological water surfaces in urban areas. In general, eye tracking can be an innovative approach to design urban spaces in such a way that new designs, which increase the ecological value of the city, are also effectively seen by the public. This, in turn, might raise awareness of the importance of such open spaces.

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Periurban landscapes in metropolitan areas: exploring land cover dynamics across typologies (Loupa Ramos *et al*.)

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Abstract:
Peri-urban areas have been conceptually framed as encompassing both characteristics of the urban and rural world and to be located somewhere in-between the urban core and the rural landscape. From a spatial perspective, an urban–rural gradient is described by the urbanization process and the patterns of urban cover. In an attempt to characterise the key features of peri-urban areas surrounding Lisbon (Portugal), a multidisciplinary panel identified the main dimensions setting the character of peri-urban landscapes which, together with the input of local and regional stakeholders, led to the mapping of a typology for the 211 parishes (LAU 2 Level) in the Metropolitan Area of Lisbon (MAL). Here, based on CORINE Land Cover data for 1990 and 2006, a cluster analysis was applied to identify major land cover patterns and dynamics in the multidisciplinary typologies of parishes within the MAL, using both a static view of the 2006 land cover map and a dynamic view based on the changes occurring during the 1990-2006 period. Seven different types of parish could be identified in 2006, which vary foremost according to the composition and diversity of land cover categories and landscape fragmentation. It stands out that for 4 types, even though with similar urban presence, significant differences can be found due to varying combinations of the agriculture mosaic, annual and permanent crops, wild land and other artificial land cover classes. Those types are mostly formed by the interaction between the different classes and fragmentation of the landscape, demonstrating that that there is no clear-cut urban-centric model, informing the urban-rural gradient, which can be singularly explained by the quantitative increase of urbanized area. This argument becomes even stronger when observing the 1990-2006 dynamics. In spite of a general increase in urbanized area, land cover changes are not fully explained by a transition of agriculture or wild lands to urban. Furthermore, urbanization processes (consolidation, expansion or spot spreading) are not the sole drivers of change. There are simultaneously other processes taking place that suggest an intensification and specialization of agriculture, or the settlement of other artificial areas (e.g., major infrastructures and facilities) on former agricultural land.

Greening for growth: lessons from business led retrofitting of natural environment features at a neighbourhood scale (Davenport and Beaumont)

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Abstract:
The natural environment provides goods and services that deliver quality of life benefits for town and city dwellers (UK National Ecosystem Assessment, 2011). Increasingly, improvements in quality, extent and access to the natural environment are advocated to provide greater benefits to society and to deliver adaptation to predicted climate change (Fuller et al., 2007, Gill et al., 2007 & GLA, 2011).

In the densest areas of built environment the foremost way to achieve this is retrofitting natural features (often described as green infrastructure or GI). Authors including Gedge et al. 2012, Gunnell et al., 2012 and Graham et al. 2012 have addressed gaps in technical guidance for the specification of such features, and cite examples of individual retrofitting interventions which are deemed best practice. Still absent are practical examples of how to plan and undertake retrofitting in a coherent way at a neighbourhood level.
The approach of the Victoria Business Improvement District's (BID) Greening for Growth Project has been adopted by others as a practical model for delivering a programme of environmental improvements in an urban centre. The project seeks to use and embed a biodiverse GI to create a vibrant, sustainable and climate resilient business area with a clear sense of place. It is led by a sub-group of the BID and Natural England, The Greater London Authority and Westminster City Council.

Stage one of the project audited existing GI resource within the BID and ascertained opportunities for retrofitting. Using desk and field based analysis a potential 1.25ha of new terrestrial GI;1.69ha of enhancements to existing GI; and, suitable space for 25ha of green roofs were identified (Victoria Business Improvement District, 2010). Opportunities were rated according to ease of delivery and potential for high quality interventions that reflect local biodiversity priorities.

A second stage of analysis found that existing green infrastructure assets divert up to 112,400m3 of storm water run-off from the local sewer system every year, resulting in between £20,638 and £29,006 annual CO2 and energy savings (Victoria Business Improvement District, 2013). The work highlighted that large canopy trees were a key assets of the area and succession planning was needed to maintain the current level of benefits.

This evidence base has generated an awareness of urban greening and encouraged BID members to invest in green infrastructure as part of their long-term building refurbishments. Although focused on retrofitting, the principles of the project have influenced major regeneration strategies in Victoria. Projects such as bee forage gardens and green walls not identified in the original audit are also being put forward by businesses.

The high resolution of the data has allowed the BID to prioritise which building owners to approach first and where investment is best spent. Part of Victoria's success has been in its choice of stakeholder language. Framing GI projects as part of a long-term strategy, it was able to identify where it could establish quick wins as key demonstration projects and give investors something tangible to work with.

11 other London BIDs have now undertaken an audit using the Victoria approach, revealing the potential for 300 rain gardens, 200 green walls and 100 ha of green roofs. Businesses find the natural environment audit approach a unifying theme for place making decisions with Local Authorities and land owners, and are discussing opportunities to include them within spatial planning policies (Victoria Business Improvement District, 2013).

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Urban green spaces – the effects of patch size and distance to the urban edge on vascular plant and bird species diversity (Matthies *et al*.)

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Abstract:
Green spaces in cities provide habitat to numerous vascular plant and bird species (Knapp et al., 2008, Kühn et al., 2004, Meffert & Dziock 2012, Melles et al., 2003) and may fulfill basic nature conservation functions (Niemelä, 1999). However, little is known about patterns of species diversity and key factors that influence species numbers for different statuses, such as ovreall, native or endangered species. Therefore, the aim of our study was to test for the effects of the size of green spaces and their distance to the urban edge on species numbers of vascular plants and birds. In particular, the following hypotheses were tested for urban green spaces in Hannover, Germany.
i) Total, native and endangered species numbers of vascular plants as well as birds increase with increasing patch size.
ii) Total, native and endangered species numbers of vascular plants as well as birds decrease with increasing distance to the urban edge.

We surveyed 32 green spaces identified by a stratified random selection, taking patch size and distance to the urban edge into account. Patch size varied from 0.7 ha to 72.3 ha, and distance to the urban edge from 190 m to 2872 m. The selected green spaces included forests, parks, cemeteries, allotments and fallow lands. A survey of vascular plants (self-established as well as planted) was conducted from June to August 2011 and March to May 2012. Birds were surveyed using line transects during the breeding season from March to June 2012. Correlation and regression analysis was conducted to detect the relationship between species numbers and patch size as well as distance to the urban edge.

A total of 1372 vascular plant species, including 577 native and 109 endangered species were found. In addition we identified a total of 79 bird species, including 75 native and 20 endangered species. Vascular plant and bird species numbers are not correlated to the distance of green spaces to the urban edge. In contrast, the total numbers as well as the number of native and endangered species of vascular plants and birds are significantly positively correlated to the size of urban green spaces (Table 1). This relationship can be best described by a logarithmic function (e.g. Figure 1 and Figure 2).

Our results suggest that the distance to the urban edge has little impact on the number of plant and bird species in green spaces. In contrast, size of green spaces in cities is a relevant factor determining vascular plant and bird species diversity. Therefore, in growing cities, planners should focus on the conservation of large green spaces to maintain high species numbers. Accordingly, in newly planned as well as shrinking cities it is necessary to concentrate on the establishment of large green patches in order to enhance species diversity.

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The Hare, the Tortoise, and the Trojan Mouse. Raising the bar for progressive landscape change (Scott)

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Abstract:
Landlife founded one of the UK's first Urban Wildlife groups in 1975, and wrote the first urban conservation strategy for Liverpool in 1983. In 2001 Landlife opened the National Wildflower Centre, in Knowsley on the edge of Liverpool, one of a very few landmark Millennium Projects with an environmental theme.

Landlife's experience as a pioneer in creative conservation has provided many examples of what is possible, often in unlikely places. Landlife has always been about the challenge of bringing ecology into the city and involving people in the process; but increasingly these creative and innovative solutions to low cost ecological landscaping are proving equally appropriate to the landscape writ large; as the decline in biodiversity continues despite 50 plus years of conservation effort. The work also demonstrates the necessity of raising public awareness to stimulate activity beyond small conservation sites and academic circles. Over the last ten years Landlife has researched and practised a new way of planting trees and wildflowers together using a new soil inversion technique, which brings major biodiversity impacts and community celebration to new tree plantings. This has been demonstrated so far on 267 hectares of land at various locations across the UK.

This presentation will explain the evolution of Landlife's work, from street corners to rural landscapes, and make clear how a single small organisation has delivered practical and large scale landscape change across the United Kingdom and indeed inspired similar styles of project working overseas. It has proven this can be done at cost many times less than traditional landscape practice. As a refreshing contrast to bureaucratic policy shifts, that consistently re-invent conservations priorities, and operate under a changing language and terminology, Landlife's work is an example of a kind of ratchet effect, which, amongst other things, has established a National visitor centre in Knowsley and is linked to a Merseyside based wildflower seed industry.

Landlife was responsible for the Society for Ecological Restoration bringing its International Conference outside North America for the first time, and contributed to the Society for Ecological Restoration's symposium and submission to the EU Commission on green infrastructure at the Ceske Budejovice in 2012. At a time of recession when the environment always slides down the scale of government priorities, it is a certainty and priority that ecologists must more actively engage with society, and do so in more creative ways, otherwise projects will happen even at a landscape scale, without really being noticed. Landlife's project work has been cited as inspiration for projects in Europe, Central America, and more recently China. Creative landscape solutions for conservation originate in urban areas and their lessons should be taken seriously in European landscape scenarios in terms of imagination, cost, benefit and impact.

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Bridging scales in green infrastructure planning (Sjöman)

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Abstract:
With predictions and indications of what may be expected in the future in terms of urban expansion, land use change and new climate conditions, the role of urban green infrastructure is recognized for its multifunctional benefits and superior capacity to a wide range of ecosystem services. As such, green infrastructure and green space planning are with no doubt an imperative tool to advance our towns and cities into systems of complex adaptation to unexpected change. From this perspective, individual green space quality and site level conditions become essential to a resilient landscape in a larger scale context and to the making of a flexible web that will allow and adapt to unforeseen change.

However, knowledge of why, where, and how urban green space may integrate in relation to its local and far reaching performance needs to progress and develop. This is most important in European cities where the compact city form governs the concept of sustainable development and less space for vegetation and permeable surface covers may reduce the connectivity of the overall green infrastructure.

Based on a case study in southern Sweden, methods to link green space performance to site specific conditions were tested as an integral part of the new development scheme of Lomma Harbour, (funded by the Delegation of Sustainable Cities, Swedish Government). With the micro-climate simulation tool of ENVImet, illustrative conclusions of where to strategically place vegetation in order to reduce wind speed, and lower mean radiant temperatures have helped create a new perspective on future green space planning. By pointing to the species specific performance of individual trees and alternative green structures, and how the strategic placing of vegetation interlaces with the goals and initiatives of real estate developers and municipality, the study has helped further why and how green space implementation contribute to the objectives of energy efficiency, less wear and tear on building materials, a better microclimate for human wellbeing etc. The approach puts a further focus on the dispersed green structure in the urban landscape – a green structure predominantly existing along streets, pedestrian precincts and parking lots, and within the private realm of residential areas. Recognition of the ecosystem services provided by site level green structure will subsequently also help securing green spaces competing with artificial infrastructural functions and point towards joint capacities of e.g. runoff mitigation, recreational values, increased biodiversity, etc.

Although the study is case specific to Lomma Harbour, the aim is also to encourage an international discussion in how to bridge green infrastructural planning to a site level perspective on quality and performance, and how, in turn, site level green space influences and strengthens an overall landscape resilience.

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Poster Presentations

Analyzing land cover changes and urbanization pattern in a tourist Mediterranean landscape (Rimini, Italy) (Morri *et al*.)

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Abstract:
Over the past sixty years rapid urbanization has significantly modified ecosystem structures, functions, and services in many Mediterranean landscapes, especially where flood plain and coastal areas occurred (European Environment Agency, 2006). Analysis of such changes in a spatial-temporal framework and quantifying the loss of Ecosystem Services is needed both to understand and assess the ecological consequences and to plan sustainable management for the future (Lautenbach et al., 2011).

Rimini (North eastern Italy) is an outstanding example of Mediterranean coastal urbanization, which has affected many western European tourist areas, and where urban spread was accompanied by steady agricultural intensification and/or decline. By the comparison of three maps derived from interpretation of remote sensing data we assessed land cover changes in the Rimini Municipality since the mid-1950s. Each map was analyzed using landscape metrics, while direction, quality and, magnitude of transitions were obtained by overlaying pairs of maps. Using multivariate ordination techniques the derived data set was analysed to detect the main direction of change. We also calculated changes in land cover capacity to supply regulating Ecosystem Services, which are responsible for human welfare (Costanza et al., 1997; Turner et al., 2007; Scolozzi et al., 2012).

Since the mid '50s more than 70% of the Rimini landscape changed substantially. The main causes were agricultural intensification (46%) and urbanization (19%). Such changes occurred principally in the floodplain area. As for regulating Ecosystem Services, Rimini municipality landscape, lost much of its capacity to provide services such as flood protection or water purification.

Evaluation of land cover change and ecosystem services supply represent a preliminary appraisal of the ecological processes involved in land use change that may foster strategies for sustainable landscape planning and management.

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Change detection of a built-up areas on the coast using spatially enhanced SPOT panchromatic and landstat TM images (Alphan and Guvensoy)

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Abstract
This paper aims to map and analyze past and present spatial patterns of built-up areas in a coastal town on the Mediterranean coast of Turkey, which has undergone rapid development of multistorey summer apartments in the last three decades. Resolution merge operations were employed for each date using SPOT Panchromatic and Landsat TM images to produce spatially and spectrally enhanced images. Built-up features on the enhanced images were analyzed and the resulting maps were analyzed in terms of changes of the built-up areas and landscape transformations that they created. Causes of these changes and the resulting change patterns were discussed.

Key Words: change detection, built-up areas, resolution merge, Mediterranean coast

Introduction
Urban growth patterns, which reflect expansion of built up areas, vary across different regions and countries for different time periods (Wu and Zhang, 2012). Urbanization process is a major factor of change in the Mediterranean region, where pre-urban cities and new urban settlements have been developed over recent decades (Weber and Puissant, 2003). Urbanization is a complex process that causes profound changes not only in cultural, sociological and economical aspects but also in ecological aspects of the environment (Wu and Zhang, 2012). Conversion of natural land cover and rural agriculture to mostly residential uses is the greatest source of landscape fragmentation (Munroe et al., 2005). It results from the complex interaction between policy, biophysical characteristics and socioeconomic development pressure (Munroe et al., 2005). Landscape fragmentation due to road construction, urbanization, land use/land cover change (LUCC) and other anthropogenic factors leads to more and smaller habitat patches, increased isolation among habitat patches, decreased complexity of patch shape, and higher proportions of edge habitat (Saunders, Mislivets, Chen, & Cleland, 2002). The need to detect and monitor urbanization is increasing, given its multifaceted nature and the diversity of environmental problems that it creates.

The eastern Mediterranean part of Turkey has the largest continuous extent of natural coastal habitats on the Turkish Mediterranean coast (Berberoğlu, 2003). However, this coastal region is undergoing rapid development with consequent impacts (Berberoğlu et al., 2004). Agricultural expansion and urbanization are the most prominent forces fueling destruction trends in (semi)natural vegetation cover in the Mediterranean. Agriculture expands over marginal areas, while urban areas grow at the expense of highly productive croplands on the coast, leading to greatly increased demand for new agricultural areas (Alphan and Yılmaz, 2005).

The main objective of this paper is to provide a methodology for evaluating changes in built-up areas on a narrow coastal strip using image enhancement and change detection techniques. The changes were discussed from landscape transformations and environmental resource management points of view.

Study Area and Methodology
Study area is located on the Eastern Mediterranean coast of Turkey. The area is subject to dramatic landscape changes mainly driven by development of multi-storey summer apartments occupying a narrow strip on the coast.

This area has recently undergone rapid and extensive changes due to unprecedented tourism development on prime agricultural lands and agricultural expansion on the foothills of Taurus Mountains. This process changes the spatial configuration of agricultural areas from previously

dominant citrus plantations on the coast to a mixed pattern of greenhouses and citrus plantations behind the developed coastal land (Alphan and Derse, 2012). Development that started in mid-1980s and concomitant improvement of transportation infrastructure have made the region accessible from many different parts of the country.
This study focuses on producing change information of built-up areas. The impacts of these developments on this coastal environment such as landscape fragmentation were interpreted on the basis of spatial characteristics of the change. Resolution merge operations were employed using SPOT Panchromatic and Landsat TM images. Built-up features on spatially and spectrally enhanced images were mapped. The results were interpreted in terms of changes of the built-up areas and landscape transformations that they created. Causes of these changes and the resulting change patterns were discussed.

Results
The aim of this paper is to detect spatial coverage of built up areas and its change over time in the case of a coastal town located on the Mediterranean region of Turkey. Changes were quantified and the results showed that building development has taken place both on the coastline and in the inner coast (i.e., 100-500m landwards from the coastline). However, characteristics of the development were quite different. Providing change information helped to understand development trends on the coastline and inner coast from past to present and underlying driving forces. Built-up areas along the coastline consisted of large multistorey buildings, sometimes as tall as 60 m. Building development behind the coastline, however, mostly occurred due to expanding local settlements that consist of small residential single-storey buildings.

Acknowledgements
This project is supported by Scientific and Technological Research Council of Turkey (TUBITAK) under the grant number CAYDAG 111Y253.

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Characterising the spatial diversity of the urbanisation process in a suburban landscape (Verplaetse and Van Eetvelde)

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Abstract:
Urbanisation refers to the complex interaction of different processes which transform landscapes traditionally formed by rural lifestyles into urban ones. As urban areas grow in population, they are expanding and occupying the agricultural and natural environment and ecosystems. This process of urbanisation has caused fundamental changes in land use and landscape patterns and has affected the countryside directly and indirectly over increasingly vast areas, resulting in highly complex suburban landscapes. This fragmented, metropolitan landscape has multiple functions varying from more urban functions like residential, commercial and industrial, to agriculture, nature conservation and forestry with a specific ecological function. Consequently the spatial structure of the landscape changed and resulted in a fuzzy transition between urban and rural areas.

The task of improving environmental and living conditions as well as the planning of sustainable development demands new understanding about how urban landscapes evolve and which factors are affecting their functioning. New approaches to the management of urban regions, such as gentrification, use of open spaces, urban agriculture, and garden complexes, depend on improvements in our knowledge of the urbanisation process and patterns. For example, urban agriculture can take place on the bare plots scattered in the residential areas and can help to protect the urban environment in a variety of ways.

In the policy documents related to spatial planning, Flanders is considered as one metropolitan area, but it is characterized by heterogeneous suburban landscapes. In this study we aim to understand the effects of urbanisation on the landscape patterns and diversity in the area of Ghent (Belgium) as an example of a suburban transition from the city to the more rural countryside characterised by different types of urbanisation. The following research questions will be addressed:
How does land use pattern relate to the types of urbanisation?
How can landscape diversity be used as an indicator for the local differences and urban gradient of the landscape including fragmentation and heterogeneity?
What are the implications of landscape diversity for functions like urban agriculture and garden complexes?

The analysis of the land use patterns and landscape diversity in the urban region of Ghent is based on the geo-database of a late twentieth century topographical map (scale 1:10.000, National Geographic Institute of Belgium). The database includes detailed classes differentiating residential and other built-up areas, garden plots, infrastructure, greenhouses, meadows and arable fields, and different types of forest. A series of composition and fragmentation metrics in FRAGSTATS is used to describe land use pattern and landscape diversity. The results of the metric analysis will provide new insights into the multifunctional urban gradient of Ghent as an example for the metropolitan area of Flanders.

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The role of urban food system in an innovative regional planning thinking (Oliveira and Morgado)

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Abstract:
Among the basic essentials for life — air, water, shelter and food — planners have traditionally addressed them all with the exception of food. Urban food planning set out to identify new ways of tackling issues, providing a suite of ideas and innovations that cities should now embrace. This approach seems to be particularly relevant in the context of a global crisis and in a country where territorial cohesion needs urgently to be addressed in the sense of establishing efficient dynamics between urban, peri-urban and rural territories.
The food system is largely thought as a rural issue and therefore beyond the scope of the urban planning agenda. Nevertheless, for the foreseeable future, food planning looks set on becoming an important and legitimate part of the planning agenda in developed and developing countries alike according to many relevant arguments: economic efficiency; climate change; social, economic and environmental sustainability; food security; renewable energy, public health; environmental quality, local development; cultural identity, among others.

In Portugal, roughly 27% of the population lives in the Metropolitan Area of Lisbon (MAL) and yet its farming surface represents about 2.5% of the total national farming surface. Food planning is rather far away from the regional planning debate so far.

How should the food equation be defined in this metropolitan area? How could food system planning create new dynamics between urban, peri-urban and rural territories? Which kind of strategy would better fit in the regional and local planning system? Which initiatives are emerging in the field towards an urban-rural food web?

Those are some of the questions that this paper aims at in order to provide innovative ideas to set up a food planning strategy for the MAL.

The determination of factors causing the urban sprawl in open space (Zimova)

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Abstract:
Residential and commercial urbanization has a significant tendency to influence the changes in open space. As a consequence of this phenomenon, the main land use types transformed by urban development are farmland or forest areas which are very important parts of our open space. These changes influence the commercial and non-commercial functions of the open space and are irreversible. The most urgent problems of urban sprawl are considered to be decrease of food production, changes in local hydrological systems, loss of spatial heterogeneity of the landscape and change of landscape character.

The urbanization process is dominant across Europe; nevertheless it has irregular tendencies. The development pressure put on open space is in several levels of different administrative units. As to the causes of development growths, different factors are considered, such as the price and quality of farmland, the distance from urban centres, environmental qualities of the landscape, the character of neighbouring landscapes or the economic potential of the region. However, there still remains the question of which factors are truly responsible for urban growth in open space.

The main objective of this research is to determine factors that really cause urban development between different administrative units. The second objective is to measure urban growth by using Geographical Information System (GIS). The GIS analyses are based on current aerial photos which are compared to aerial photos from the 1990s. The results of the analyses offer information about the increased areas of urban development. The gathered data are then input into the statistical analyses. The statistical testing of the determined factors verifies their impacts on the urbanized landscape.

All data are gathered from several administrative units in the Czech Republic. The data are sorted into 4 classes by the number of inhabitants in the selected areas and they are comprised of development, economic, environmental, landscape and social analyses. The basic statistic data were gained from the Czech Statistical Office (CZSO).

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The concept of connectivity and structural Forest Connectors the case study of Ljubljana, Slovinia (Hladnik and Pirnat)

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Abstract:
To a large part of the population living within cities and towns, green areas and remnants of natural vegetation represent a continuum of the natural environment and daily contact with nature. In addition to new green areas emerging on abandoned agricultural land in urban and suburban areas, the preservation of a landscape structure with close-to-natural or semi-natural ecotopes is an important task of urban forestry. Forest management planning, especially in an urban environment, needs to focus on the balance of forest ecosystem integrity and a rising demand on social based ecosystem services within broad topics of human health and well-being.

The evolution of the cultural landscape and the process of human landscape modification in Slovenia have created a diverse structure of ecotope patterns in a predominantly forested landscape (Hladnik, 2005). Even in the agricultural landscape, forest patches and remnants of natural vegetation were retained on the least accessible sites and places not suitable for agriculture. Similar processes of forming the cultural landscape were observed in urban and suburban areas (Hladnik and Pirnat, 2011), despite new trends of urbanisation in the last decades. Spatial planning aimed at preserving natural processes in a cultural landscape may consider using landscape elements of the former natural vegetation as a connection between the inner city green areas and the natural environment.

Based on the concept of connectivity in landscape ecology, an assumption that urban green areas and remnants of natural vegetation may represent similar stepping stones within the urban environment was made. The goals of the study are to determine the amount of forest continuum areas within a walking distance inside the city of Ljubljana and to present a spatial model that will enable maintaining or complementing the network of forest patches and other green areas within the city (Hladnik and Pirnat, 2011). In the first step of the study, urban city areas were extracted from the CORINE Land Cover map and analyzed in a GIS with land cover data and a forest stand map acquired from the interpretation of digital orthophoto images and field assessments. The continuum of forest and other green areas was estimated using maps from the 18th and 19th centuries. Based on the material dating back to the cartographic activities in the period of the most intensive settlement and forest clearings it was estimated that land-forming factors mainly affected the types of settlement in the past, whereas one half of today´s forest area represent the continuum of the natural environment within the city.

The importance of strategic points for maintaining biodiversity on a landscape level, which has already been addressed by Forman and Collinge (1997), is becoming one of the crucial issues in urban forest management. In the second step of our research, we will focus on the strategic points and the connectivity of forest patches encompassing the areas of natural vegetation using morphological spatial pattern analysis (MSPA) of forest habitats (Saura et al., 2011) in Ljubljana urban forest areas.

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Monitoring urban changes across a century in the Romanian Carpathians using landscape metrics (Huzui *et al*.)

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Abstract:
Urban expansion didn't follow a utopian conformation to the territorial regulations and systematisations, but was achieved spontaneously, according to socio-economic vectors. This type of spatio-temporal development is reflected in a fragmented morphology (Frankhauser, 1994) that can be monitored through landscape metrics (Pătru-Stupariu et al., 2011).

This paper sought to evaluate landscape changes in the case of Sinaia town which is representative of the mountainous urban settlement typology in Romania. We selected FRAGSTATS software (McGarigal et al., 2002) version 3.3 to compute the landscape metrics. To evaluate changes in the land use pattern we used three metrics (CONTAG, AGREG, SPLIT), depending on their usefulness in urban planning (Botequilha-Leitão et al., 2006) and were computed for the entire landscape. The territory was divided in 12 homogenous urban patches that represent uniform structures of land use types (Herold et al., 2002). Boundaries between patches were established on streets and plot edges. The grid cell size is 0.5m at the analysis scale of 1:5,000 which allows a correct identification of relations between urban landscape elements (plots, plot edges, buildings, streets, green areas and vacant land).
Landscape metric values were compared between t1 (year 1907) when a large share of Sinaia's urban tissue was configured, being considered a model of equilibrium between the urban components, and t2, year 2009. In terms of dynamics within landscape composition and configuration, we found that between 1907 and 2009 there is a trend of amplification in the diversity and fragmentation of the entire landscape (as expressed by all three landscape metrics). Urban landscape patches tend to acquire similar features by reducing the green areas and extending the built-up surfaces. The extending fragmentation is also marked by intercalated land functions and the insertion of untypical buildings for the initial patches.

Landscape structure was characterised based on four features: diversity, fragmentation, aggregation and complexity. The metrics emphasised the diminished landscape connectivity, determined by the increase in patch number (from 58 in t1-1907 to 878 in t2-2009). The CONTAG metric helped illustrate the landscape change trajectory towards fragmentation. Thus, when meadows were the dominant element (over 50% of land use in moment t1) the values of this metric were high in comparison to the subsequent moment t2 when there is a diversity of land uses (leisure, residential, industrial and commercial). Building restrictions in neighbourhoods that are located on the slopes of Bucegi Mountains relate to landslides and soil erosion and are reflected in the reduced landscape fragmentation. This is due to the delayed insertion of single-family housing structures. On the other hand, neighbourhoods that have traditionally polarised this type of building and pavilion housing during communism are characterized by lower values of landscape aggregation.

Applying these metrics we obtained data on the landscape composition and configuration that was combined with ancillary data and provided tools monitoring the spatial heterogeneity and the related intrinsic processes of the urban landscape.

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Guidelines to integrate biodiversity into construction projects (Barra)

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Abstract:

The construction industry is facing increasing requirements to design more energy efficient and airtight buildings to meet global warming targets. This focus reduces the importance attached to preservation of biodiversity and ecosystem services. In this article, we show that these buildings are not ecological-friendly if we consider their entire life cycle from cradle to cradle. First, materials used in construction- their sourcing, assembly and disposal – have large consequences regarding both GHG emissions and ecological footprint. Second, biodiversity is often considered only as “protection of species” - (bird nests, green plants or beehives) or “green painting” (industrial green roofs) while actors should focus on maintenance of ecological processes and functions. Thus, Natureparif encourage the actors to think in a life cycle approach regarding: planning - construction - management of properties and end-of-life of buildings, both in time and space. Following this framework, we propose to maintain/restore/enhance biodiversity through:

The choice of location and the refurbishment of existing buildings in order to reduce urban sprawl and soil sealing;

The design of buildings that are compatible with the local context (hydrology, climate, habitats and species, ecological networks/corridors soils parameters, human context) ;

The choice of materials, their sourcing and disposal;
Green space design and management;
Ecological engineering systems such as wetland for water treatment and green roofs;
Energy mix production reaching self-sufficiency and short distance synergies such as urban agriculture.

These guidelines do not only benefit biodiversity but also citizen’s health and well-being.

Landscape ecology and management of urban forests in Finland (Löfström *et al*.)

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Abstract:
Urban forests are important recreational areas for Finnish people and they enhance the quality of urban living environments. Management of urban forests is challenging because management measures can be easily noticed and thus, publicly criticised. Urban residents have a strong emotional bond with the nearby nature and various opinions about how the forests should be managed. Recreational use, scenery, health of the forests, nature values and residents opinions all have to be taken into account in the management decisions.
Urban Forests – Planning and Management guide book offers information about forests situated in residential areas and their characteristics, planning and management. New research results in the areas of recreational use, biodiversity and regeneration of urban forests are presented in the book. Urban forests are defined as forests with natural understorey vegetation situated within or around built-up urban areas.

Recommendations for planning, management and use of the urban forests are given in the book. One main theme is the consolidation of multiple uses. New methods for participatory and multi-objective planning where residents' and forest users' opinions are taken into account in preparing the use and management plans for urban forests are introduced. The last part of the book envisages future challenges and presents methods for preserving and enhancing biodiversity and attractiveness of urban forests. These methods aim to more practical and socially acceptable solutions.

In addition to urban forests the guidelines given cover other recreational forests, national parks and nature attractions. Furthermore, the management guidelines can be applied to the forests situated near summer houses and to those commercial forests where biodiversity and recreational use are being highlighted in addition to timber production.

The book is aimed at foresters, environmental managers and greenery experts working with urban forests as well as at the use of organisations, students and all readers interested in the topic. The authors include researchers and experts from Finnish Forest Research Institute and several other organisations giving their insights in urban forests from their own perspectives.

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Planning for green infrastructure in urban areas – towards an Ecosystems Approach (Phillips)

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Abstract:
Urban planning and design is increasingly looking towards techniques that work with rather than against natural processes. The drivers behind this shift in emphasis are multiple, varied and interrelated though one of the most significant issues is global climate change and its locally felt impacts. Furthermore, the use of traditionally engineered interventions (e.g. air conditioning, flood defences, underground drainage infrastructure etc) to design out climate change risk is often unsustainable due to cost, environmental impact and lack of flexibility. In response, urban planners and designers are now looking to environmental engineers to develop sustainable, 'green infrastructure' led solutions that are more cost effective, contribute to environmental enhancement and are more flexible to changing circumstances. This paper presents a new, multi-scalar approach to urban planning and design that seeks to protect, restore and enhance key natural processes. The newly developed approach aims to ensure that urban decision-making works to increase climate change resilience whilst also delivering multiple benefits to communities and the local environment. This notion of 'working with nature for multiple benefits' is core to the ecosystems approach which the research aims to operationalise through the development of tools, models and guidance for use by urban planners and designers. The new approach has been developed in the form of a toolkit and practitioners can choose to adopt the approach wholesale or use certain elements only for specific projects. The research has used Glasgow (United Kingdom) as a case study and whilst the new approach has been designed for integration with the Scottish planning system, it is of relevance to urban planning and design elsewhere.

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Efficiency of available data usage for sustainable spatial planning: an example from the Czech Republic (Aubrechtová)

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Abstract:
This research examines the how diverse publicly available datasets from multiples sources in the Czech Republic are used by local planning authorities. Post-communist Czech Republic has amassed a very large amount of freely accessible data related to environmental protection. The national new Building Act compels local planning authorities to produce Planning Analytic Materials (PAM) documentation to define main planning issues for Urban Plans. The rate of usage of public accessible data in the PAM, quality of documentation, and existing urban plans are assessed in relation to the three main landscape-ecology issues of concern identified in the Czech Statistical Yearbook of the Environment: erosion, flooding, and fragmentation. A study of 266 urban plans from 55 villages with delegated power shows that the legally required data for PAM are used by planning authorities without issue. However, the use of non-compulsory data is rare. The slightest attention is paid to Fragmentation of the landscape. Results also suggest that local planning staff may be unfamiliar with landscape ecology issues, which may explain why the available data are not used to the fullest extent possible. The analysis shows that PAM provides a powerful urban planning tool, which, due to its connection to Urban Plans specifications can significantly influence and improve new proposals of Urban Plans. Local planning authorities may be made better aware of the free data accessibility and receive training in incorporating these data into planning.
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